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(54) **COMBINATION UNIT AND COMBINATION METHOD OF MULTIPLE MEMBRANE SHELLS**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

2,059,390 A * 11/1936 Pagel B65D 67/00

206/443

3,059,941 A * 10/1962 Kaynor F16L 21/05

277/603

(Continued)

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(57) **ABSTRACT**

The present invention discloses a combination unit and method of multiple membrane shells. The combination unit of multiple membrane shells is formed by bundling multiple membrane shells in parallel, wherein the raw water port and the concentrated water port of each of the membrane shells are respectively connected and sealed with the raw water port and the concentrated water port of the adjacent membrane shells to form the shared raw water port and the shared concentrated water port which are respectively connected with the raw water pipeline and the concentrated water pipeline. Since each of the combination units of multiple membrane shells is provided with the shared raw water port and the shared concentrated water port, it is adequate to finish the assembly of the shared raw water port with the pipeline and the assembly of the shared concentrated water port with the pipeline in the engineering installation. The combination unit of multiple membrane shells can be placed horizontally or vertically. By adopting the technology of the combination unit of multiple membrane shells, there does not need a large number of clamps, the number of sealed points is decreased, the engineering cost is reduced, the hidden seepage danger is lowered, the engineering installation workload is lessened, the occupied area of the apparatus is saved, and the maintenance and the service are convenient.

10 Claims, 6 Drawing Sheets

